

VIRGINIA AGRICULTURAL COUNCIL PREPROPOSAL FORM

Title: Integrated Approaches to Management of Plant Parasitic Nematodes in Row Crops

Objectives:

- 1) Identify optimal combinations of nematode management tactics that minimize the need for chemical inputs
- 2) Evaluate cultural practices, including cover crops and rotations, for impacts on plant parasitic nematodes
- 3) Assess profitability of integrated approaches to nematode management

Justification:

Plant parasitic nematodes are a perennial constraint to production in a variety of economic crops including row crops, vegetables, and ornamentals. In the southeastern U.S., yield losses to nematodes are particularly prevalent due to warm climates and sandy soils that favor high populations of these plant parasites. A variety of tools are available for management of plant parasitic nematodes including cultural methods, biological control, host plant resistance, and seed-treatment nematicides, but thus far these practices have fallen short of providing the level of control obtained by in-furrow granular nematicides (e.g. aldicarb) and fumigants (e.g. metam sodium). The environmental and health consequences of using these nematicides has led to increased regulation, cost, and in some cases, removal of the product from the market. The overall objective of this project is to optimize integrated pest management practices for nematode control in row crops (cotton, soybean, corn, peanut) through incorporation of cultural methods, biological control, host plant resistance, and, when necessary, seed treatment and in-furrow nematicides. Yield responses to nematicides, biologicals, and cultural practices are inconsistent, but previous data on their performance provides a basis for which to select candidate products/practices for integration into multi-tactic approaches. It is unlikely that any one approach will provide adequate control, so an increased understanding of how interactions among tactics alter the effectiveness of nematode management is needed.

Approach:

Objectives will be accomplished through a combination of on-farm trials and field plots at agricultural research stations throughout the state. Individual tactics will be evaluated, but the focus will be integrating multiple strategies over time for suppression of plant parasitic nematodes and reductions in crop losses to these pests. Grower surveys, development of electronic databases and educational resources for producers and extension personnel, workshops, and field days will also be incorporated into the project in order to increase clientele awareness of the economic impacts of plant parasitic nematodes and options for their management.

For the first objective, factorial, randomized experiments evaluating the impacts of host susceptibility (susceptible, resistant, or tolerant), nematicides (with or without seed treatment), and biologicals (with or without) over multiple years will be conducted in plant parasitic nematode-infested fields. A metam sodium fumigated "control" will be included for comparison. Different rotations (e.g. cotton-peanut and soybean-corn) will be evaluated. Nematode populations will be characterized and nematode damage will be assessed for each of the treatment combinations.

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For the second objective, on-farm trials will be conducted to evaluate cropping system impacts on nematode populations and nematode damage to the economic crop. Treatments will include different cover crops and crop rotation sequences. Cover crop treatments will be selected based on cover crop species or mixtures that are most likely to be incorporated into Virginia cropping systems for value-added benefits. Treatments will include a non-host cover crop for the target nematode, a biofumigant cover crop (*Brassica* spp.), a cover crop that is likely to support nematode reproduction, a fallow weed-free treatment, and a fallow treatment without weed control. Cash crops will be planted following the cover crop in a split plot design (cover crop as the main plot and cash crop as the subplot) and consist of either a crop that is most likely to result in the highest economic returns based on current markets (e.g. continuous cotton or soybean) or a crop that is most appropriate to mitigate impacts of plant parasitic nematodes and other diseases (e.g. a non-host for the target nematode and diseases). This cropping sequence will be replicated over three years and multiple sites. Nematode populations following the cover crop and cash crop, nematode damage, yield, and economic returns for each treatment will be evaluated.

For the third objective, a cost-benefit analysis will be conducted for each of the nematode management tactics or combinations of tactics. Input costs (seed, nematicide, biopesticide) and current market prices for each commodity (USDA-ERS) will be determined. Estimated labor costs associated with management tactics will also be included in the analysis. Based on incremental or combined yield impacts of different management approaches, the value of the yield increase (if present) will be calculated based on the current market price of the crop. The costs of management, whether in the form of input costs or the estimated loss of profit due to growing a less valuable rotation crop, will be subtracted from the value of the crop to determine the economic impact of different management tactics. Since many of the approaches being proposed entail long-term management of plant parasitic nematodes, multi-year economic analyses will be conducted to determine the overall net benefits or loss. Estimated economic returns of different management tactics will be refined as more data is obtained over the course of this project and beyond.

Economic Impact on Virginia Agriculture:

In several economic crops it is estimated that nematodes cause 10% or greater yield losses annually in the U.S., and in many cases this far exceeds crop losses to fungi, bacteria, and viruses. In Virginia in 2013 and 2014, estimates for yield losses to nematodes in soybean and cotton exceeded combined losses to all other diseases and reduced profits by an estimated \$10-20 million. Objectives 1 and 2 of the proposed project will produce efficacy data for cropping-system level approaches to nematode management and recommendations for selection of rotation and cover crops to reduce target nematode populations. This will provide growers with information on how to minimize crop losses to nematodes with reduced reliance on expensive in-furrow nematicides and fumigants. Completion of objective 3 will result in identification of the most economical options for nematode management in row crops through a cost-benefit analysis. The three objectives combined will provide growers with recommendations and tools to minimize economic losses while minimizing costly inputs, thereby increasing the overall profitability of crop production in Virginia.

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DURATION (years) one ____ two X

BUDGET (yr. one) \$20,000 (total) \$40,000

***One pre-proposal per PI please**

COMMODITY GROUPS	CHECK <u>ONE</u> GROUP THAT BEST DESCRIBES YOUR PROJECT
Aquaculture	
Fruit/Wine	
Livestock Dairy Poultry Hogs Beef Sheep Goats Horses	
Nursery/ Forestry	
Row Crops	X
Turf/Seed	
Vegetable	
Educational	
Miscellaneous Agriculture	